ECS Mid-Atlantic, LLC
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SHRINK-SWELL SOIL INVESTIGATION

ECS CLIENT: John Connell
104 Marlin Circle
Yorktown, VA 23692

DATE: November 18, 2009

PROJECT NAME: 104 Marlin Circle

ECS PROJECT #: 07:10480

PROJECT ID:
SUBDIVISION: MILL COVE
LOT: 104 MARLIN CIRCLE
COUNTY, STATE: YORK COUNTY, VIRGINIA
ADC MAP PAGE/GRID: GHR / 8791 / K-2

PROPOSED CONSTRUCTION: (Building Type/Foundation Loading)
Two story wood-framed attached garage constructed on a monolithic slab on grade or shallow spread footings. Foundation loading not expected to exceed 3 kips per linear foot for walls or 10 kips for columns.

SITE CHARACTERISTICS: (Topography / Existing Development / Vegetation / Drainage / Etc.)
BASED ON SITE VISIT BY: Ryan Reynolds **ON:** 11/09/09

The site has an existing one-story wood-framed residence with a detached carport. The carport area is being replaced with a two story garage.

SUBSURFACE CONDITIONS: [BASED ON HAND AUGER BORINGS]

- **Fill Encountered: Yes** [ ] **No** [X] **Groundwater Encountered: Yes** [ ] **No** [X]
- **Laboratory Test Results:**

Boring Number	Depth (inches)	Moisture Content, %	Atterberg Limits (LL/PL/PI)	%-Passing #200 Sieve	USCS Symbol
HA-2	24-48	22.9	41/21/20	35.6	SC

- **SCS-USDA Soil Series:** Tomotley **Shrink Swell Potential:** LOW

FOUNDATION RECOMMENDATIONS: [See Attachment "Additional Design and Construction Notes"]

Bearing Capacity [Based on IBC 2006, Table 1804.2] – 2000 psf
Minimum Column Footing Width – See Detail Sheet
Minimum Footing Embedment Depth – See Detail Sheets
Minimum Footing Thickness – See Detail Sheet
Steel Reinforcement – See Detail Sheet
Additional Notes – Footings should be extended through all fill soils (if encountered) to suitable, firm Natural soils.

ENGINEER'S SEAL
COMMONWEALTH OF VIRGINIA
MICHAEL J. GALLI
Lic. No. 030684
12/18/09
PROFESSIONAL ENGINEER
DATE: 11/18/09

HAND AUGER BORING LOCATION DIAGRAM

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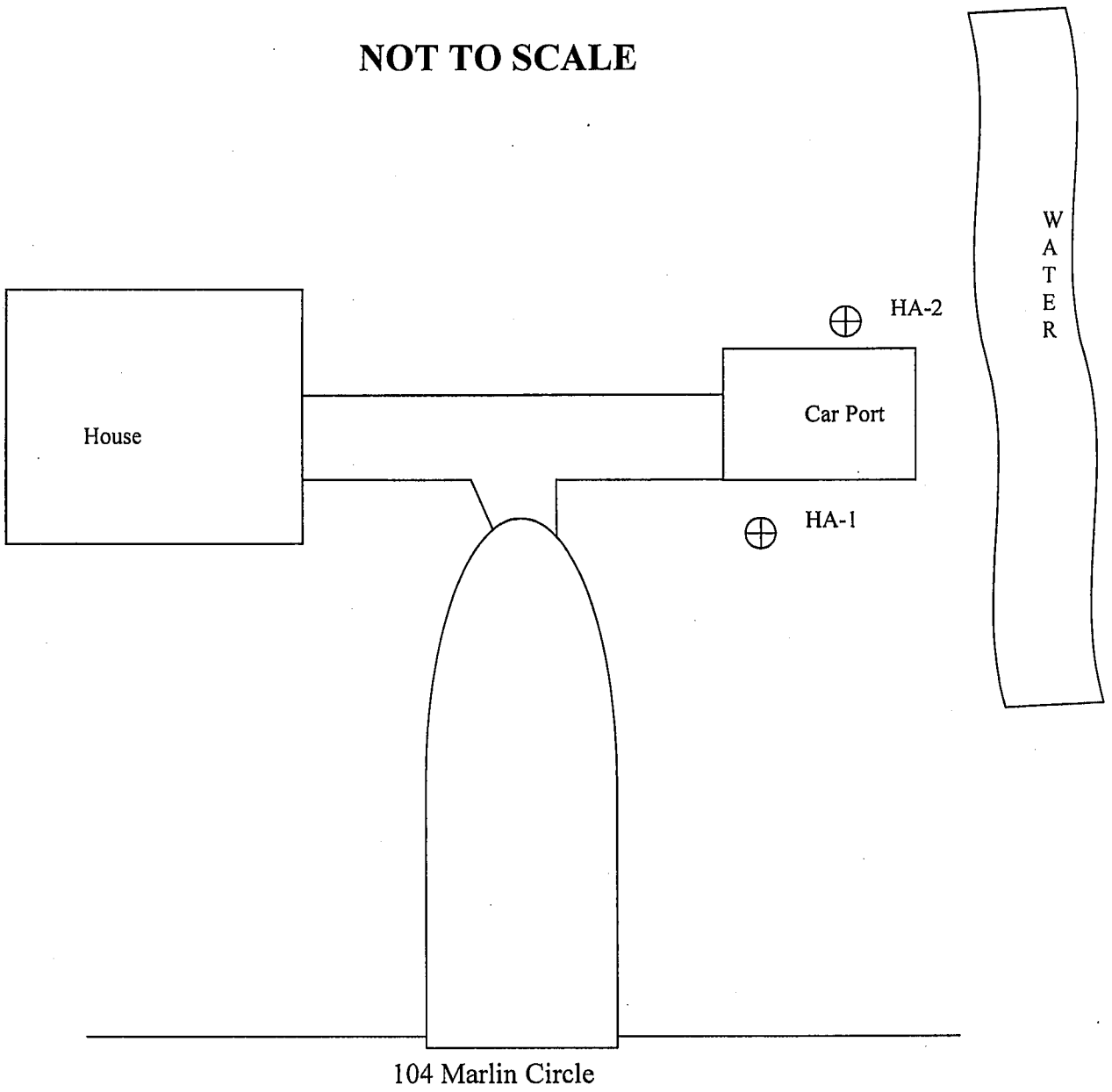
NOT TO SCALE



⊕ = **Approximate hand auger boring location**

MONOLITHIC SLAB FOOTING DESIGN DETAIL

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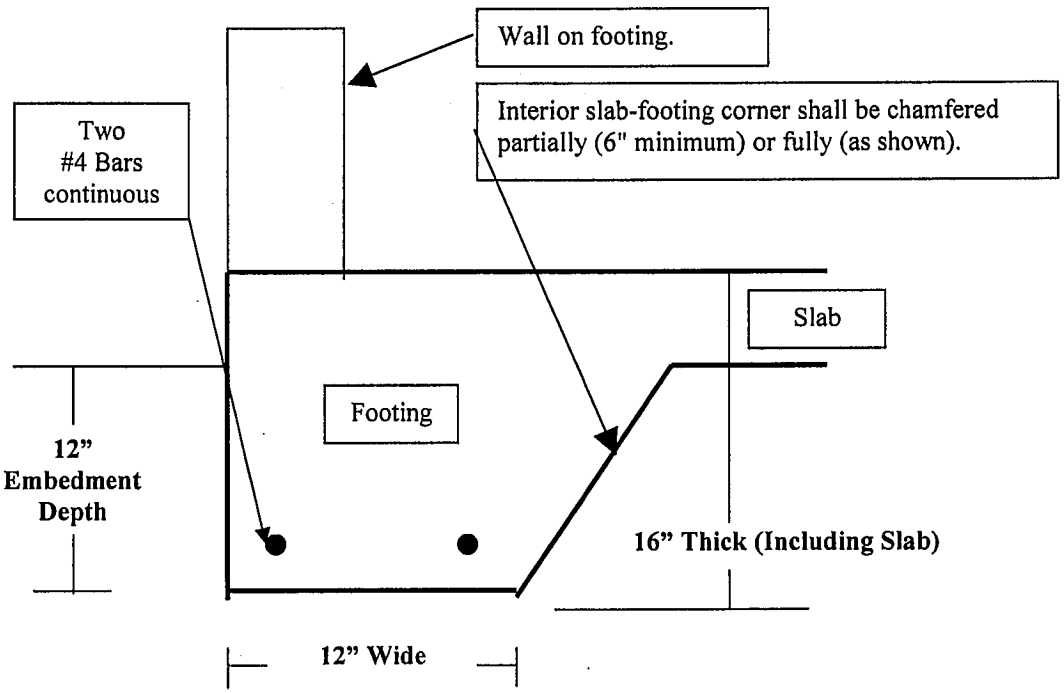

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NOTES:

DETAIL SHOWS TYPICAL FOOTING CROSS SECTION WITH THE MINIMUM RECOMMENDED DIMENSIONS.

TWO CONTINUOUS #4 REINFORCING BARS SHALL BE PROVIDED THROUGHOUT ALL FOOTINGS, AND ALL REINFORCING STEEL SHALL BE SECURED IN PLACE AND LAPPED A MINIMUM OF 20-INCHES WHERE SPLICED. PROVIDE A MINIMUM OF 3-INCHES OF CLEARANCE FROM THE SIDES AND BOTTOM OF THE EXCAVATION.

THIS FOOTING DETAIL IS FOR A MONOLITHIC TURN-DOWN SLAB EDGE FOOTING. SLAB SHOULD ALSO BE REINFORCED WITH WELDED WIRE MESH TURNED DOWN INTO FOOTING. SLAB SHALL BE DIRECTLY UNDERLAIN WITH A SUITABLE VAPOR BARRIER AND 4" OF POROUS FILL.

FOOTING DESIGN DETAIL

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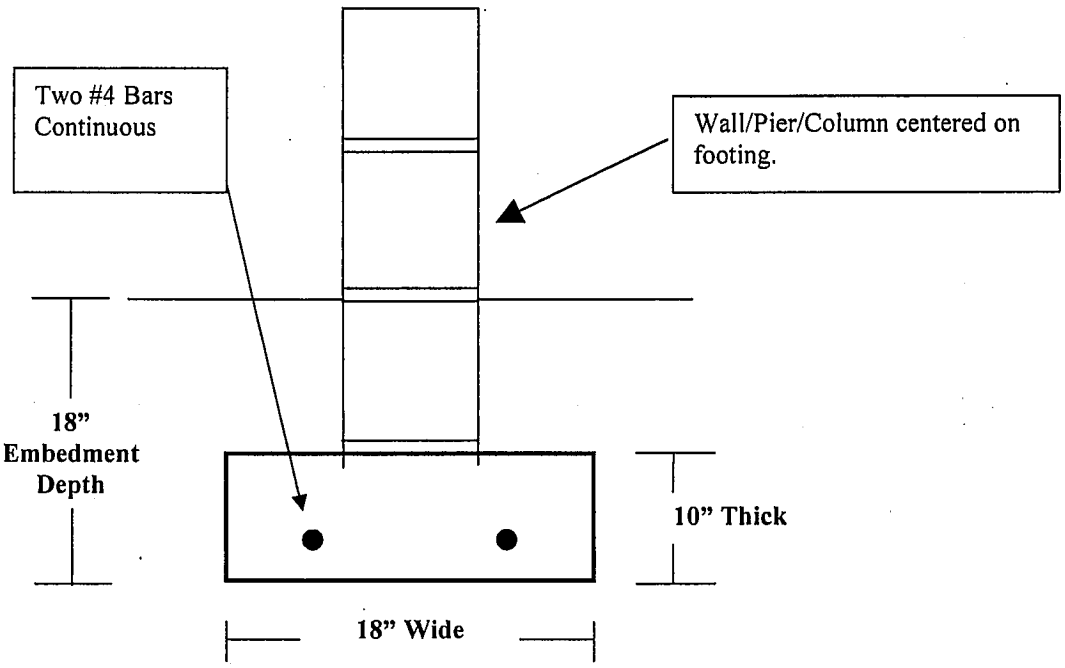

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11/18/09
PROFESSIONAL ENGINEER

DATE: 11/18/09

NOTES:
DETAIL SHOWS TYPICAL WALL FOOTING CROSS SECTION WITH THE MINIMUM RECOMMENDED DIMENSIONS. TWO CONTINUOUS #4 REINFORCING BARS SHALL BE PROVIDED THROUGHOUT ALL WALL FOOTINGS.

ALL REINFORCING STEEL SHALL BE SECURED IN PLACE AND LAPPED A MINIMUM OF 20-INCHES WHERE SPLICED. PROVIDE A MINIMUM OF 3-INCHES OF CLEARANCE FROM THE SIDES AND BOTTOM OF THE EXCAVATION.

FOOTINGS SHOULD BE EXTENDED THROUGH ALL FILL SOILS (IF ENCOUNTERED) TO SUITABLE FIRM NATURAL SOILS.

HAND AUGER BORING LOGS

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DEPTH (inches)	LOCATION: HA-1
	DESCRIPTION OF MATERIALS
0-24	Silty Sand (SM), Grey, Moist
24-48	Fine to Medium SAND (SC), Brown, Moist
48-72	Fine to Medium Clayey SAND (SC), Brown-Orange-Grey, Moist
	GROUNDWATER NOT ENCOUNTERED
	END OF BORING AT 72 INCHES

DEPTH (inches)	LOCATION: HA-2
	DESCRIPTION OF MATERIALS
0-24	Silty Sand (SM), Grey, Moist
24-48	Fine to Medium Clayey SAND (SC), Brown-Orange-Grey, Moist
48-72	Fine to Medium Clayey SAND (SC), Brown-Orange-Grey, Moist
	GROUNDWATER NOT ENCOUNTERED
	END OF BORING AT 72 INCHES

Note: Soils were classified in general accordance with ASTM D-2488 (Description and Identification of Soils - Visual/Manual Procedures)

ATTACHMENT FOR ADDITIONAL DESIGN AND CONSTRUCTION NOTES
[ECS SHRINK-SWELL SOIL INVESTIGATION]

EXPLORATION PROCEDURES

This exploration was accomplished by performing shallow hand auger borings within the approximate limits of the proposed building construction. Visual classification was performed, and available Soil Survey data from the Soil Conservation Service publications was reviewed.

The soil deposits encountered in the borings were classified in the field in general accordance with ASTM D-2488 (Description and Identification of Soils - Visual/Manual Procedures). Representative samples of soils encountered were collected from the borings and returned to our Williamsburg laboratory for moisture content, sieve analyses, and Atterberg Limits (plasticity) testing, as appropriate.

FOUNDATION DESIGN

The net allowable soil pressure referenced in the cover report is based on our experience with soils in the project area as well as the "Presumptive Bearing Values of Foundation Materials" as outlined in Table 1804.2 of the 2006 Inter-National Building Code. Therefore, it is considered essential that all footing excavations and subgrade areas be observed by a qualified inspector for conformance with the Virginia Uniform Statewide Building Code and to assure that the recommendations made herein are consistent with the conditions encountered during construction.

The minimum recommended foundation excavation and footing embedment depths are based on laboratory test results, field observations, and anticipated shrink-swell conditions. These depths may be increased at the time of construction if uncontrolled fill, unsuitable soils or unidentified moderate or high potential shrink-swell soils are encountered. If shrink-swell soils are present, it is recommended that the minimum foundation excavation and footing embedment depth be increased to effectively penetrate the zone of seasonal moisture change and break the continuity between the soils exterior of the home and those below the first level floor (slab-on-grade or crawl space). This depth should be specified by the geotechnical engineer. In this regard, the minimum depth is intended to minimize soil activity (shrink-swell) as a result of extreme moisture fluctuations and will also satisfy frost protection and bearing capacity considerations. Footings should be lowered and stepped as necessary to maintain minimum excavation and embedment depths and achieve stable bearing. Footings located on/or near slopes will need to be stepped as necessary to maintain the required embedment depth and to prevent foundation failure due to soil creep.

Additionally, based on the IRC 2006, Section R404.1.3, "concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice when either of the following conditions exists: (1) Walls are subject to hydrostatic pressure from groundwater or (2) Walls supporting more than 48 inches of unbalanced backfill that do not have permanent lateral support at the top or bottom." Based on the proposed construction (or our assumptions), neither condition exists and therefore the foundation walls do not need to be designed.

CONSTRUCTION CONSIDERATIONS

In general, all footing excavations should extend through all uncontrolled fill, soft or otherwise unsuitable material so as to expose firm, natural soils. Where soft or unsuitable materials are encountered below the minimum excavation depths, they should be removed. Footings may be placed at this undercut elevation or bottom of footing grades may be raised, as directed by the geotechnical engineer, to the minimum footing embedment depth by backfilling with No. 57 Stone or flowable fill. Flowable fill must have a minimum 28 day compressive strength of 200 psi. A qualified inspector should be called on to observe all footing excavations for conformance with the Virginia Uniform Statewide Building Code prior to placement of stone flowable fill, and/or concrete to ascertain that firm bearing soils have been exposed.

If perched groundwater is encountered during foundation excavation, sumps should be excavated perpendicular to the proposed foundation wall such that water drains from the foundation into the lowest point of the excavation. If excessive moisture accumulations occur, especially during wet seasonal conditions, the footings could be over-excavated about 6 to 12 inches (depending on severity at time of construction) and a drainage layer of No. 57 Stone placed to allow for water runoff and discharge while concrete is placed. Water can then be discharged outside the construction limits with the use of submersible pumps. To help drain wet conditions (if appropriate); the main interior pier line could be supported by a strip footing poured monolithically with the exterior wall footing.

Care should be exercised to prevent water from ponding above or within the bearing soils. A slight swale should be constructed uphill of the homesite (if appropriate) to intercept surface runoff and divert it away from the foundations. Any natural drainage should be diverted away from the foundations. The final site grading should allow for strong positive drainage away from the foundation. We recommend a fall of at least 6 inches be provided for the first 10 feet outward from the foundation walls. For lots with moderate to high shrink-swell potential, gutters are recommended. We recommend gutter effluent be discharged at a point at least 5 feet outward from the foundation walls.

LIMITATIONS

It should be noted that this study was limited in scope to two (2) hand auger borings and classification type laboratory testing only. The borings were generally extended to a maximum depth of 72 inches or hand auger refusal. The recommendations contained herein were based on the data obtained from the hand auger borings, which indicate subsurface conditions at these specific locations at the time of the exploration. Soil conditions may vary between borings. Subsurface conditions below the depths explored, which could affect building foundations and settlements were not investigated.

Furthermore, it is sometimes difficult to characterize soil content and consistency using hand auger borings alone. Therefore, as a critical part of a complete soil evaluation, all footing excavations should be observed by a qualified inspector for conformance with the Virginia Uniform Statewide Building Code and to ascertain that soil conditions encountered by our exploration are consistent with conditions encountered during construction. If the soil conditions encountered during construction are consistent with those as included herein, no additional studies should be necessary. However, if during the course of construction variations appear evident, the geotechnical engineer should be informed so that the conditions can be addressed.